Design of a Complete Water-Works System for Gary, Lake County, Indiana

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DESIGN OF

A

COMPLETE WATER-WORKS SYSTEM

FOR

GARY, LAKE COUNTY, INDIANA

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A THESIS PRESENTED

By

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To The

PRESIDENT AND FACULTY

Of

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FOR THE DEGREE OF

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HAVING COMPLETED THE PRESCRIBED COURSE

In

CIVIL ENGINEERING

Alfred E. Phillips.
Prof. Civil Engineering
Howard M. Raymond.
Dean of Eng. Studies
L. C. Monin
Dean of the Cultural Studies.

The Design of a Complete Water-Works System for the City of Gary, Lake County, Indiana.

The method of procedure in the design of this water-works system may be outlined as follows: (1) Field work, (2) Distributing system, (3) Pumping station and wells, (4) Specifications and estimates of quantity.

Under the field work comes the determination of the elevations of the street intersections, width of streets, etc. This survey was made during the last week in October, 1906, and was accomplished by the use of a level and tape. The grades of the streets are all uniform from corner to corner. A map of the city was drawn showing the plan and the elevations of street corners.

Following comes the design of the pipe lines or distributing system. The supply was estimated from the total population which was figured on twenty years from the present time, and taken at 40,000. The maximum supply was figured on sixteen fire streams at 250 gals. per minute for four hours.

250 x 16 x 4 x 60 = 960,000 gals.

After a careful study of the geological conditions, we decided to take the supply from bored wells rather than the great expense of taking it from the lake, the water underground being of the very best kind at a depth of 300 ft. below the surface. Five 10" wells were bored, 200 ft. deep. Water rises in the wells

to within 50 ft. of the surface, from which it is pumped into a 1,800,000 gals. impounding reservoir, from which it is pumped into the distributing system.

Under the design of the pumping station and wells, we design the structures for the machinery, and under the specifications are given the kind and capacity of machines to be used.

The next step is the writing of the specifications. These specify the material, with reference to quality, quantity and workmanship, necessary for the completion of the parts of this system.

The last step consists of the estimating of the quantities required for the system. This estimate would, however, be only a close approximation.

Design of Distributing System and Pipe Line

Allowing 125 gals. per capita consumption for an estimated population of 40,000, twenty years hence, gives the total required domestic supply as 5,000,000 gals. every 24 hours.

Figuring on 16 fire streams at 250 gals. per minute and allowing for a maximum play of four hours, gives the quantity of water required for fire purposes in 24 hours as 960,000 gals.

Therefore, the total demand on the system will be 5,960,000 gals. per day.

The next step is to divide the town up into districts so as to get the percentage of water required in each section. This was done by drawing north and south lines, the Fillmore, Madison, Delaware and Tennessee Streets, thus dividing the town into three sections. By assuming an average family of 5 persons

on every 25 x 125 lot, we determined that Section I, Fillmore to Madison, would consume 35%; Section II, Madison to Delaware, 34%; and Section III, Delaware to Tennessee, 31% of total supply.

By an inspection of the elevations on the map, it can be seen that it will be hardest to maintain the required pressure of 40#, at the corner of Tennessee and Eighth Avenue. Therefore, we started at this point and worked back to the pumping station in designing the pipe line. A Hand Book, issued by the Massillon Iron & Steel Co., was used in determining the velocities and friction losses in the line.

No pipes smaller than 6" in diameter are used, and no velocity greater than 6' per second allowed.

SAMPLE COMPUTATION (Tennessee St. to Pumping Station)

2720' of 16" pipe $Q = \frac{5075}{2} = 2537$ Gals/min.

From Tables, Head Lost = 12.24' Veloc. = 4.07 ft/sec.

2625' of 20" pipe $Q = \frac{6255}{2} = 3127$ gals/min.

Head lost = 5.9' Veloc. = 3.2'/sec.

1000' of 30" pipe $Q = 3127$

Head lost = .325 Veloc. = 1.42'/sec.

40# pressure = 92.16' head

Total head required at station (approx).

= 92.160 + 12.24 + 5.9 + .325 = 110.6'

A glance at the blue prints will show the system employed in the distribution, i.e., two main pipes, one on Eighth Avenue, and the other in the alley between Fifth and Sixth Avenues, connected by 6", 8" and 12" laterals as the case may require.

These two main pipes were each designed to take half of

the total supply needed in the sections through which they run. The main pipes are also designed to take the 4,000 gals. per minute required for fire in addition to the domestic supply.

Hydrants are so placed that any fire, no matter where situated, can be reached from at least three hydrants without using excessive lengths of hose.

In addition to the pipes supplying water to the town of Gary proper, a 10" pipe is carried over to the steel mills across the Calumet River.

The distribution of water through town shown in tabulated form is as follows:

		Domestic	Fire	Total F + D
35%	Section I	1214 gals/min.	4000 gals./min.	5214
34.3	Section II	1180 " "	" " "	5180
31%	Section III	1075 " "	" " "	5075
100%		3469 " "		

COLLECTION AND STORAGE OF WATER

There are two practical ways of supplying water to the town of Gary, one is by building a tunnel out a half mile or so into Lake Michigan and the other is by sinking deep wells.

After a careful consideration of the question, from an economic standpoint, we decided in favor of the deep well method, for Gary is built on clean sand and good drinking water can be found by boring anywhere in the town.

The total amount required by town in 24 hours is 5,960,000 gals. Five 10" pipes sunk to suitable depth, will more than supply this amount, giving a required velocity of only 3.47 ft. per sec. in the pipes.

An impounding well, or reservoir, will be needed to pump this water into, as it would not be practicable to pump directly into the mains.

This reservoir should have a capacity of 1,800,000 gals, or in other words, should hold 4 hours domestic and 4 hours fire supply. This will necessitate a reservoir 30' high and 80' x 100' plan, of reinforced concrete. Wall to be 18" thick at top and 24" at bottom, supported by counterforts every 10'.

As counterforts are to be used, the wall itself can be designed as a beam between 10' supports. The applied load being figured according to the head of water on section. Steel reinforcing is computed for 5' sections and is to be put in as shown in print.

The roof is supported by posts making no span longer than 25 ft. By the use of small transverse beams, the roof span is made 5 ft., which will allow a 2-inch thickness of roof to be used. All beams and roof to be reinforced as shown by the plan. Sizes being computed from tables given in Buehl & Hill's Reinforced Concrete.

GENERAL SPECIFICATIONS

And

CONDITIONS OF AGREEMENT.

The work will be considered and detailed specifications are drawn under the following divisions:

1 - Furnishing cast iron pipe and special castings.

2 - Furnishing hydrants, valves and valve-boxes.

3 - Laying pipe and setting hydrants, valves and valve-boxes

4 - Furnishing and setting up pumping machinery.

5 - Furnishing and setting boilers, feed pump, heater, etc.

6 - Building pumping station and chimney.

7 - Furnishing material for and constructing reservoir.

Bidders will divide their bids, giving prices for the work under the separate divisions mentioned above, together with a lump bid for the construction of the complete plant.

It is intended that these specifications, and each contract and specification shall cover the completion of the work to which it relates.

By the term city, is meant the city of Gary, Indiana, acting through its proper authorities.

Wherever the term "Water Works Committee" is used, it shall be understood to mean the committee representing the Common Council in the prosecution of the work to be performed under and in accordance with these specifications.

Wherever the term "Engineer"is used, it shall be understood to refer to the Engineer, in the employ of the city, having direct charge of the water works construction, and to his authorized assistants.

Wherever the word "Contractor" is used, it shall be understood to refer to the party or parties contracting to perform the work to be done under these general and detail specifications, or the legal representative of such party or parties.

Bids will not be received for the work involved under these specifications, except from parties having had experience in such work, and who can furnish satisfactory proof of their ability to carry on the construction of the whole or part of the system in a thorough and workmanlike manner.

The contractor is to furnish, at his own cost and expense, all transportation, plant, tools, labor, materials, and all else requisite to execute and complete the work in the best possible and most expeditious manner, and according to the drawings and specifications and their intended meaning.

He shall employ competent foremen and experienced mechanics and laborers, and shall discharge immediately, whenever requested by the Engineer to do so, any man who is incompetent or disposed to be disorderly, and shall not again employ such person on the work.

All materials furnished and work done will be inspected by the Engineer, and if not in accordance with these specifications and contract, they will be rejected and immediately removed, and other work done and material furnished in accordance therewith. If the Contractor refuses to remove the work and materials as above ordered, then the Engineer and Water Works Committee shall have the

right and authority to stop the contractor and his work at once and to supply men and materials at the cost and expense of the contractor; such expense to be deducted from any moneys then due, or to become due to the contractor from the city.

And it is further intended that inspection shall not relieve the contractor from his responsibility to do true and accurate work; and the contractor shall furnish all necessary facilities, should it be deemed advisable to make any examination of the work already completed. If any be found defective in any respect, he shall defray the expenses of such examination and of satisfactory reconstruction. If all be found satisfactory, such expense will be paid by the city. The Engineer and Water Works Committee shall have the right to reject, at any time previous to the final settlement with the contractor any work or materials which may be fould faulty, even though such faults may have been previously overlooked.

The successful bidder must sign the contract for the work to be done by him, within ten (10) days after the contract is awarded to him, and must begin work at the time fixed for him to begin, in accordance with the detailed specifications for the several portions of the work. He shall proceed with the work, prosecuting it with due diligence from day to day, and complete it at the time fixed.

The contractor must follow strictly and without delay, all instructions and orders given by the Engineer in the performance of his work. In the event of the contractor's absence from the work, he must leave it in charge of a duly authorized representative, to whom orders and instructions may be given. If he fails to do this, then the contractor will be held respondible for the proper carrying out of such orders and instructions as it may be necessary for the

Engineer to give to any superintendent, foreman or other employe about the work.

The contractor will be held responsible for the entire work until completed and accepted by the city, and until he is formally released from his obligations. He is required not to assign or sublet his contract without permission from the city, but must keep it in his name and control until completed and accepted, and in case of his absence from the work, must have a duly qualitifed person to take care of it.

No charge shall be made by the contractor for any delays or hindrance from any cause during the progress of any portion of the work embraced in his contract.

If the delay be caused by any act or neglect of the city, then he will be entitled to an extension of the time allowed for the completion of the work, sufficient to compensate for the delay, provided the contractor shall give the city immediate notice of the cause in writing. If the contractor fails to complete the work at the date specified, he shall forfeit to the city, as confessed the liquidated damages, and amounts named in each of the specifications for the different portions of the work.

Before the work will be considered as completed, all rubbish and unused material due to, or connected with the construction, must be removed and the premises left in a condition satisfactory to the city. All sidewalks and crosswalks must be cleared up streets, curbs, crosswalks, sidewalks, fences and other public and private property disturbed or damaged, must be restored to their former condition, and final payment will be withheld until such work is finished.

Should any disagreement or difference arise as to the

true meaning of the drawings or specifications at any point, or concerning the character of the work, the decision of the Engineer shall be final and conclusive, and binding on all parties to the contract.

The city reserves the right to increase or decrease the quantity of work, or any part thereof, to the amount found necessary. No allowance will be made, in case of increase, for any sum above the rate of price bid, nor in case of decrease for any real or supposed damage or loss of profit occasioned by such diminution. The time fixed for the completion of the work will be proportionately increased or diminished.

During unsuitable weather all work must stop when such work would be liable to be injured, and it must be suitably protected from such possible injury.

No extra work will be paid for or allowed, unless the same is done upon the written order of the Engineer, Subject to this condition, extra work will be paid for according to the schedule of prices bid. Where prices for the work are not included in the schedule, ten per cent advance upon the actual cost, as determined by the Engineer, will be paid to the contractor. All claims for extra work must be made in writing before the payment of the next succeeding estimate after the work shall have been performed. Any failure on the part of the contractor to make such claim, will work a forfeit of the same.

All city, county or state laws, ordinances or regulations limiting or controlling the action or operation of those engaged upon the work, or affecting the materials applied to them, must be respected or attended to.

The contractor will be required in his contract to preserve the city harmless from all claims for damages, from any and all causes and natures whatsoever, in connection with his work or any part thereof, and also to act as defendant in each and every suit of any and every nature which may be brought against the city by reason of, or connected with the work done under this contract.

Unless otherwise provided for in the detail specifications, the Engineer during the last week of each month, will make an approximate estimate of the value of the work done during that month, and the contractor will be paid the amount due him under his contract, on the fifteenth (15th) day of the month following.

A final estimate of all work done and materials delivered according to the contract and these specifications, will be made as soon after the Engineer has been notified of the completion of the work, as he can satisfy himself by tests, examinations or otherwise, that the work has been and is finally and fully completed in accordance with the contract and specifications, and the contractor will be paid as hereinafter provided. Before such final payment will be made, the contractor must satisfy the city that all bills for labor and materials used in the work have been paid.

The contractor will be furnished with one set of drawings, prints or tracings, and a set of specifications, giving all the details and dimensions necessary for carrying out his portion of the work. Dimensions given in figures will have the preference over the scale where there is any discrepancy.

If the bidder does not fully understand the plans and specifications, or is in doubt as to the Engineer's ideas and intentions, concerning any part or portion of the work, he must satisfy himself by inquiry of the Engineer, before bidding, for he will be held rigidly to the Engineer's interpretation of the plans

after the contract is drawn. The plans and specifications are intended as complete, but should anything be omitted from them which is necessary to complete the work in accordance with the apparent intention of the Engineer, it will be supplied by the contractor, and at no extra cost to the city. Any work done by the contractor which is strictly extra work, will be settled for as provided above.

All materials, lines and grades must be in full accordance with the plans, and no deviation from the plans and specifications will be allowed, except by written authority of the Engineer and Water Works Committee.

The copy of plans and specifications furnished the contractor must be kept constantly at the work, must be well cared for and returned to the Engineer when the work is completed.

The Engineer will stake out all the work and set all necessary grade-stakes; and the contractor is required to preserve all stakes bench-marks etc., set or established along the line of the work, until duly authorized to move them. If moved by carelessness or without authority, they will be set, if needed, at the expense of the contractor.

Each bid for the work must be accompanied by a certified check or its equivalent, as a guarantee that the bidder will enter into a contract with the city to do the work according to the plans and specifications, and for the amount of the bid. The amount of such check shall be five hundred dollars ($500.00).

This deposit will be retained and placed to the credit of the party whose bid is accepted, and will be forfeited if he fails to enter into and execute the contract awarded to him.

In case of the failure of the bidder, to whom the contract is awarded, to sign the contract, the city reserves the right to

accept any other bid made, and all checks will be held until contract is signed, when they will all be returned.

As security for the proper performance of the work, a bond acceptable to the city of an amount up to one-fourth the amount of the contract, will be required, and the city will pay at the times specified only eighty (80) per cent of the monthly estimates of work properly performed and materials delivered, after deducting all charges against the contractor, retaining the twenty (20) per cent until the completion of the contract and the final acceptance of the work.

Proposals must be enclosed in sealed envelopes, and each must have written on it plainly, the words, "Proposal for Water Works." Each proposal must be addressed to the Secretary of the Water Works Committee of the city of Gary, Indiana.

No proposal will be received after the limiting time fixed for receiving proposals, and no bidder will be allowed to withdraw his proposal after it has been opened and read, unless the city fails to accept the bids for the work, within fifteen (15) days from the time of opening the proposals.

All work done must be in strict accordance with the detail specifications under their appropriate headings, and the general and detail specifications will be attached to and made a part of each contract. The general specifications and conditions of agreement are to be considered a part of the detailed specifications for each part of the work.

The final payment will be made within sixty (60) days after the formal acceptance of the work, by the Engineer and the city. Partial payments made upon estimates, either monthly or otherwise, shall not be construed as a final or partial acceptance of any

portion of the work, or as relieving the contractor in any way, from the responsibility herein contemplated.

The right is reserved to reject any and all bids.

DETAILED SPECIFICATIONS
For
FURNISHING CAST IRON PIPE
And
SPECIAL CASTINGS

The pipe shall be of the kind usually known as "Hub and Spigot", and in general each straight pipe shall be about twelve (12) feet in length from the bottom of the hub to the end of the spigot. The metal shall be of the best quality for the purpose, made from what is commercially known as "Neutral" Pig-Iron, which shall have been made from iron-ores without the admixture of cinder, and when cast into pipe the metal shall be tough, and of such density and texture as will permit its being easily cut and drilled by hand.

The City shall have the right to appoint an inspector whose duty it shall be to see that these specifications are strictly complied with; to reject any metal, mold or cast, which would, in his judgment cause imperfection in the work; to supervise the coating, testing and weighing of pipes and castings; to require at any time, specimen rods of the metal for testing, to reject after casting, any pipe or special casting which he may deem below the requisite standard of perfection, and his decision and directions shall be respected and obeyed by the Contractor.

Any palpable defect or imperfection, which may have escaped the notice of the inspector, shall be deemed sufficient

cause for rejecting any pipe or casting at any time previous to the final settlement and the completion of the contract.

The pipe-metal must possess a minimum tensile strength of at least eighteen thousand (18000) pounds per square inch.

The coating must be durable, smooth, glossy, hard, tough, perfectly waterproof, not affected by any salts or acids found in the soil, free from bubbles or blisters, strongly adhesive to the iron under all circumstances, and with no tendency to become soft enough to flow when exposed to the sun in summer, or to become so brittle as to scale off in the winter.

All pipes and castings must be delivered in all respects, sound and in conformity with these specifications. Upon their delivery at the point designated, the Water Works Committee reserves the right to subject the said pipes and castings to the same water-pressure proof and hammer tests as are above specified to be applied at the foundry; and all defective pipes or castings which may have passed the inspector at the foundry, or which may have been broken in transportation, will be rejected when there discovered, unless the same may be cut as hereinafter provided. Care must also be taken in handling the pipes and castings, not to injure the coating, and no material of any kind shall be placed in said pipes and castings during transportation, or any time after being coated. If, upon its arrival at the designated point of delivery, the spigot end of any straight pipe should be found cracked or broken, during transportation from the foundry to the said point or otherwise, such defective portion shall be cut off at the contractor's expense, provided that the same does not exceed a length of four (4) feet. A deduction from the proper original weight of such pipe, shall also be made in each such case, at the rate specified in the table of

weights, for every inch of length so cut off. No pipe or special casting in which the hub is found to be cracked or defective in any respect, will be accepted at said point of delivery or elsewhere; nor will any special casting with a defective spigot end be received, or permitted to be cut off, without the written order of the Engineer.

Pipe arriving with weight or number illegible or omitted, will not be received, but will be subject to the same conditions as cracked or broken pipe, so far as they apply.

All tools men and materials required by the Engineer or the inspector in discharging their duties relative to the inspection at the foundry or otherwise, contemplated by these specifications, shall be furnished by the contractor, and at no expense to the city.

-- QUANTITIES --

The following is an approximate estimate of the quantities of cast iron pipe required for the construction of a water supply system for the city of Gary, Indiana, in accordance with the annexed plans and specifications:

The sizes given refer to internal diameters.

The weight of straight pipe shall be as follows:

Size	Feet	Weight per Foot	Total
30"	1,705	334	591,347
24"	830	250	207,500
20"	7,195	200	1,583,000
16"	7,685	125	960,625
14"	1,505	100	150,500
12"	57,965	75	444,737
8"	17,725	42	744,450
6"	66,930	33	2,208,690
		TOTAL-	6,890,847

Any pipe weighing less than the above by more than three (3) per cent may be rejected, and no allowances or payments will be made for any excess greater than two (2) per cent above these weights. These requirements shall be determined by the weight of each pipe

separately. All pipes shall be of such length as to closely approximate twelve (12) feet from face to face of bell when laid in the ground, and the weight per foot shall include the weight of the bell or hub.

The city shall have the right to, and may at any time previous to the shipment of the pipes and special castings, change and revise these specifications as to sizes and amounts, as may be required by the needs of the work, without change in the contract rate of payment.

Contractors in making their bids, will specify the prices per net ton of two thousand (2000) pounds, for which they will deliver each of the different sizes named, as per these specifications. Also the price per pound for special castings made in the ordinary manner, and where necessary, according to the Engineer's drawings. Detailed drawings of each size of pipe to be used in the work should accompany each bid.

The special castings must be delivered in ample time for use with the pipe with which they belong, and any extra expense incurred by the city by failure to deliver them in time, must be borne by the contractor.

The proposal for the cast-iron pipe and special castings shall state the time for the complete delivery of the quantities named in this specification. Other things equal, preference will be given to the proposal offering the earliest delivery.

The contractor will be required to forfeit, as confessed and liquidated damages, to the city, the sum of fifteen dollars ($15.00) per day, for each and every day the final delivery is delayed beyond the time specified in his proposal, and he will be required to reimburse said city for any and all damages and

increased costs of the work to the city by reasons of such delay, and to act as defendant in any and all suits which may be brought against the city by reason of such delay, or from any other cause connected with his or their contract with the city.

During the last week of such month, the Engineer will make an estimate of the amount of the several pipes laid in the trenches during that month. On the fifteenth (15th) of the succeeding month, the contractor will be paid eighty (80) per cent of the amount due him on this estimate. The balance (20 per cent) will be due and payable within sixty (60) days of final completion and test and approval by the Engineer, and acceptance by the Water Works Committee.

The right is reserved to reject any and all bids.

LIST OF SPECIAL CASTINGS.

There will be required the following approximate quantities of special castings:

Crosses	Tees	Reducers	90° Bends
1-30"x20" - 3-6"x6"	1-30x24	4-16x6	4-8"
1-30"x6"	1-30x6	2-14x6	39-6"
1-24"x20"	23-20x6	1-14x10	1-16"
6-20"x20"	24-16x6	1-20x14	1-30"
2-20"x12"	2-16x8	1-24x12	
2-20"x8"	2-14x6	1-12x6	
15-20"x6"	1-12x8	3-20x16	
2-16"x16"	4-12x6	1-8x6	
3-16"x8"	50-8x6	2-20x8	
13-16"x6"	88-6x6	2-30x6	
1-14"x14"			
1-14"x8"			
1-14"x6"			
1-12"x8"			
4-12"x6"			
1-8"x8"			

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SPECIFICATIONS

For

FURNISHING HYDRANTS, VALVES

And

VALVE-BOXES.

The valves will be of the best quality, made and of a design, to be approved by the Engineer; they will be of the kind known as double-gate, double-hub, brass mounted. Bidders will state in their proposal what manufacture of gates they propose to furnish.

They must be what are termed "heavy", must be tested to stand successfully and remain water-tight, under a pressure of three hundred (300) pounds per square inch at the factory.

The contractor will be required to guarantee their perfect condition for a period of six (6) months from the date of the final acceptance of the work, and to pay all expenses and damages which may be incurred in keeping them in perfect order for that length of time.

The valves will be made to open by turning the key to the left. They must be suitably coated.

The net area of water-way must not be less than the net area of the pipe of the same nominal diameter and in all particulars the valves must be of the best form and make, and proportioned for strength, durability and ease of working.

Defective valves will not be accepted, but will be stored, subject to the contractor's order and at his expense and risk.

The right is reserved to vary the numbers, kind and sizes

to such extent as may be necessary for the interest of the work.

Proposals must state the price per piece for each size, for use in case of increase or diminution in the quantities.

HYDRANTS.

The hydrants must be of the very best quality made, and must be either the Mathews, Ludlow, Waterous, Chapman, Galvin, or other equally good manufacture, acceptable to the Engineer. Bidders will state in their proposals what manufacture of hydrants they propose to furnish. They must be made of the best materials, such as will be durable and will insure perfect ease and freedom of motion for every moving part.

Bidders will specify the size of gate or valve opening, and inside diamater of stand pipe.

Bidders will submit prices for hydrants, with and without frost cases.

The character of the design must be such that all parts are easily accessible, and that repairs may be made at a minimum cost and in a very short time.

The drip must be such as will drain the hydrant perfectly, leaving no water standing in the stand pipe above the connecting pipe; such as will operate positively and certainly; so designed as to render it impossible to become clogged by anything liable to get into the water mains, or by roots; and such as will not easily get out of order or be difficult to repair.

The hydrants will be of proper length to use where the bottom of the pipe-trench is to be five (5) feet and six (6) inches below the surface grade. They will be designed to open to the left.

The nozzles will be cut with a thread to match the couplings now in use by the fire department of the city. The gate or valve must be so designed as to operate easily and freely and not be liable to be clogged or stuck by small pieces of foreign matter, and must be made of or faced with a material which is durable and not easily injured, which will not be liable to injure or stick to its seat, and such that should any slight injury occur to the seat or gate face, the valve will not leak.

Defective hydrants will not be accepted, but will be stored at the contractor's risk and expense and held subject to his order.

He will be required to guarantee the perfect working of the hydrants for a period of six (6) months from the date of the final settlement, and pay all expense and damages which may be incurred in keeping them in perfect working order for that length of time.

VALVE-BOXES

Prices must be named per piece for the valve-boxes to fit the valves mentioned in the fore-going list, set in mains laid in trenches varying in depth from four (4) feet six (6) inches to six (6) feet.

The proposal for furnishing hydrants, valves and valve-boxes, shall state the time for the full delivery of the materials included under this specification. Other things equal, preference will be given to the proposal offering the earliest delivery.

The contractor will be required to forfeit as confessed and liquidated damages, to the city, the sum of fifteen dollars ($15.00) per day for each and every day the final delivery is delayed beyond the time specified in his proposal, and he will be required to

reimburse said city for any and all damages and increased cost of work to the city, by reason of such delay, and to act as defendant in any and all suits, which may be brought against the city by reason of such delay, or by any other cause connected with his or their contract with the city.

The contractor or contractors will be required to contract to preserve and protect the city from all claims of infringement in the use of patented articles, and to defend any and all infringement suits brought against the city, growing out of, or due to the use, of their hydrants, valves and valve-boxes.

Drawings or models should accompany each bid.

During the last week of each month, the Engineer will make an estimate of the amount of work done under this specification during that month. On the fifteenth (15th) of the succeeding month, the contractor will be paid eighty (80) per cent of the amount due him on his estimate. The balance, twenty (20) per cent will be due and payable within sixty (60) days of the final completion and test and approval by the Engineer, and acceptance by the Water Works Committee.

The right is reserved to reject any and all bids.

SPECIFICATIONS FOR PIPE LAYING

And

SETTING HYDRANTS, VALVES and VALVE-BOXES.

The following is an approximate estimate of the total length of each size of pipe to be laid:

Size	Number of Feet
30"	1770.5
24"	830
20"	7915
16"	1505
12"	5796.5
8"	17725
6"	66930
TOTAL-	109857

The work under these specifications will include the setting of all necessary special casting in the pipe system throughout the city. Also the setting of about two hundred and thirty-five (235) hydrants, as specified below.

Also the setting of the following gate valves and valve-boxes.

Three (3)	30" gate valves
Two (2)	24" " "
Six (6)	20" " "
Ten (10)	16" " "
Three (3)	14" " "
Six (6)	12" " "
One (1)	10" " "
Twenty-Three (23)	8" " "
Seventy-Three (73)	6" " "

The above quantities must be considered only as closely approximate, and the right is reserved to modify them as may be found necessary in the progress of the work, without extra compensation to the contractor other than that due to the rate of charge for such kind of work.

The contractor will furnish all labor, materials and all plant necessary to lay the pipe in accordance with these specifications, and in a thoroughly first-class and workman-kind manner.

Any blow-off air cocks, or other connections necessary to render the work complete, will be set by the contractor at points to be designated by the Engineer.

The work will be done along such lines and streets as are indicated on the pipe distribution map of said water works system, and in such other places and streets in said city as may be directed by the city.

During each of the months of the time allowed for this work, a proportionate part of the work must be completed. Trenches for the pipes shall be opened under the direction of, and in accordance with the grades and lines to be given by the Engineer, and of such depth that the bottom of the trench shall be five feet below the grade of the street. Along the same street, the pipe lines will be laid uniformly the same distance from the street centre, in stright lines and on straight uniform grades between adjacent hydrants.

The greatest care must be exercised to insure public safety while the trenches are open, and until cause of danger appertaining to the work, is removed, by fencing, shoring, watching, lights, etc., and the contractor will be held liable for all damages due to neglect of these precautions.

The pipe will be laid in the order directed by the Engineer; and the storage of pipes and other materials on the streets, and the laying, must be so arranged as to cause the least possible interference with the public, and with the street, side-walk and crossings.

In soft ground, each pipe must be laid on three blocks, 2 in. x 8 in. by 2 ft., three for each pipe, laid equal distances apart.

Valves and hydrants, special castings, and all other appurtenances are to be placed at the places, and in the manner designated by the Engineer, specified herein and shown by the plans.

Any omission of branches, stop cocks or other appurtenances intended to be layed, shall be corrected when required, by re-opening the trench, if it has been filled up, and introducing what may have been omitted, and without extra charge upon the part of the contractor.

In hard ground, the bed of the pipe must be even, true and uniform so that the pipe will bear equally upon it for the whole of its length, and this result must be reached, either by carefully bottoming out the trenches, or by packing in and tamping solidly, sufficient earth to bring it to the proper grade. Sufficiently large holes shall be dug, to leave the bell of each pipe free, and not resting on the ground at any point.

At the time of laying, the bells and spigots shall be truly adjusted so as to give a uniform lead space all around, and the depth of lead must not be less than two (2) inches, but must be more if necessary, in order to completely fill the rabbet in the hub or bell end of pipe.

The lead must be of best quality, pure and soft, and must be calked securely and properly into place.

The gasket must be of clean hemp yarn or oakum, twisted and rammed tightly into place. Before making the joint, the bell and spigot must be wiped clean and dry, and the joint run at one poring. The calking must be faithfully executed, and the lead driven flush with the face of the work, or until it will set no further.

The pipes are to be swept clean and free from dirt and rubbish before laying, and each time of stopping work the end of the pipe line must be carefully plugged and closed to exclude animals, dirt and water.

All streets and sidewalks, crossings, public or private grounds, shall be restored to their former and original condition, the same as before work was commenced, and in every way satisfactory to the Engineer.

Great care must be taken not to remove without the consent of the proper parties, any gas pipes, water pipes, sewers, drains or cisterns, or their appurtenances, and they must be carefully shored up, supported and protected, and the pipe laid in such a way as not to harm them. After passing the above with the pipe, the earth must be very carefully compacted about them. Any damage done to any of the above, or any other public or private property, must be made good by the contractor.

If any boulders be encounted in the trench, they must be taken out and removed off the streets, or if sunk so that the tops will not be less than one foot below the bottom of the pipe. No stone larger than one man can lift, will be put back in the trench.

Whenever necessary to cross under, or in any manner interfere with the railroad, due notice shall be given to the superintendent of the same, and the crossing must not be made except with his approval as to time and manner.

In back-filling the trenches, the earth must be rammed carefully under and around the pipe up to its center, The rest of the trench may then be filled by depositing the earth in layers not to exceed six (6) inches in thickness and ramming each layer thoroughly. No boulders will be allowed in back-filling, within two (2)

feet of the top of the pipe.

In opening the trenches, the surface of the street, if of good gravel or macadam, shall be carefully removed and deposited by itself on one side of the trench, and in back-filling the surface of the street must be returned to its original condition. Any extra material necessary for this purpose, must be provided by the contractor at his own expense.

All unused or defective material, rubbish, etc., incident to the work, must be removed at once, and the street kept clean. All pieces of pipe not shorten than three (3) feet, must be used at once in the line; that which cannot be used must be removed at once to a place designated by the Engineer.

Whenever these requirements or any portion of them are unheeded or neglected, the Engineer will give the contractor due notice to that effect, and if the rubbish, etc., is not removed, or the needed repairs made, the Engineer shall have power to employ men to do such work at the expense of the contractor, and these expenses may be deducted from any moneys due him from the city.

The contractor shall maintain the pipe system in perfect order for a period of six (6) months from the time of its final acceptance by the city, and shall repair at his own expense all breaks, leaks and faults, which occur in his work, by reason of faulty material, or faulty workmanship, and shall pay all damages resulting therefrom. During this time, he shall maintain the surfaces of the streets, in their original undisturbed condition.

Pipe laid, will be measured from center to center of special castings on cross lines, or from center of special casting to end of line, and from center of main to center of hydrants.

Where specials are inserted and plugged, measurements will be made to the end of the branch.

HYDRANTS

All hydrants will be carefully examined by the contractor to see that they are in perfect working order and free from rubbish, dirt, stones, etc., before setting them, and when defects exist, he must call the Engineer's attention to the fact.

The trench to receive the hydrants will, in clay, open, porous, sandy or gravelly soil, be excavated of sufficient size, and at least one-quarter of a yard of coarse gravel or broken stone shall be placed beneath and around the hydrants, up to a point one (1) foot above the drip; Then the earth shall be tamped securely to the surface. In sandy or gravelly ground, enough broken stone shall be placed about the drip, to keep it free from clogging.

The foot of the hydrant shall be securely braced behind, to prevent injury to the bottom joint, and care must be taken to set the hydrants truly vertical. Each hydrant will be set truly at grade and will stand upon a flat stone or upon a piece of plank, 2 in. x 12 in. x 12 in.

SETTING VALVES

The contractor will examine all valves carefully, and all found defects must be rejected. Care will be taken to see that all the dome and packing-gland nuts are set up tight and properly.

All valves will be set uniformly with reference to property, or curb lines, as directed by the Engineer, and no variation greater than one(1) foot from the uniform location, will be permitted.

The prices must include the setting of all hydrants, valves, valve-boxes, etc.,

The proposal for laying cast iron pipe, special castings,

etc., shall state the time for the full completion of the work, as per this specification. Other things equal, preference will be given to the proposal offering the earliest completion of the work.

The right is reserved to reject any and all bids.

SPECIFICATIONS for FURNISHING

And

SETTING UP PUMPING MACHINERY.

The pumps may be of any standard make, such as the Worthington, Dean, Laidlow-Dunn-Gordon, the Hughes, or other manufacture equally acceptable and to be approved by the Engineer. Bidders will state in their proposals what manufacture of pumps they propose to furnish.

The pumps shall have a capacity 5,960,000 gallons per day or a maximum combined capacity of 7,500 gallons per minute.

They must be capable of pumping water into the mains under a minimum pressure of 50#.

The centrifugal pump (or pumps) to take water from the five (5) ten (10) inch bores may be of either of the above mentioned makes.

These centrifugal pumps, pump water directly from the bores into the impounding reservoir and must have a minimum capacity of 5,000,000 gallons per day, suction lift 100'.

The guages to be of a make acceptable to the Engineer, and shall be mounted on a neat walnut board at such place in the engine room as the Engineer may direct.

Each pump shall be furnished with a reliable engine counter connected to the rock shafts, to record the strokes.

The proposal must give a lump sum for furnishing all materials and labor of whatever kind or description, for the con-

structions, delivery and erection complete with all appurtenances, and with foundation for two (2) pumping machines, together with the suction pipes from the pumps to and connecting with the pipe from the reservoir.

The contractor is required to furnish the masonry for the foundations which shall conform in a general way, with the plans on file in the office of the Water Works Committee. Bidders will submit with their proposals, detail drawings, blue print copies or tracings, of the foundations of the machines that they propose to furnish.

In submitting proposals for the materials and work to be done under this specification, bidders will state the time for the complete delivery and erection of the plant. Other things equal, preference will be given to that proposal offering the earliest delivery and erection of the work.

The right is reserved to reject any and all bids.

SPECIFICATIONS For FURNISHING

And

SETTING BOILERS, HEATER, FEED PUMP, ETC.

The contractor shall furnish and erect the stack connection to chimney. It shall be made of iron not thinner than No. 10 B. G. with damper for each boiler.

The boilers shall be set in independent furnaces upon the space marked in the plan of Pumping Station and must conform as nearly as possible to the plan of "Boilers and Boiler Setting", on file in the office of the Water Works Committee.

The contractor shall furnish a full set of drawings showing all parts of the boilers as they will be erected, together with piping, foundations, etc., which shall be approved by the Engineer.

The entire lining of all walls, arches and flues exposed to the direct action of the heat, shall be made of four (4) inches of fire brick laid in fire clay.

The workmanship throughout boilers, both in construction and erection, shall be of the best, and any part of the plant, however perfect in other respects, if faulty as regards workmanship, will not be accepted.

All unfinished parts of the boilers, and all pipes, shall have two (2) coats of good paint of such color as the Engineer may select.

All parts of the machinery shall be protected from rust and erosion during erection.

The boilers shall be insured for one year, the papers to

be made out in the name of the city by some good and reliable insurance company, and at the expense of the contractor.

Great care must be taken to preserve the true form and dimensions of the boilers, and in flanging, not to crack or injure the sheets; no cracked or ragged flanges will be accepted; flanges are to be machine turned.

All steam and hot water pipes in the engine and boiler room, shall be covered with plastic asbestos or mineral wool and striped with duck sewed in place, or with removable hair felt or magnesia covering and painted, to the approval of the Engineer.

Steam for the supply of the boiler feed pump, shall be taken from the steam domes by independent connections with stop valves to disconnect either pipe from dome.

The boilers shall be connected either to be filled by the boiler feed pump from hot well, or from the main suction pipe, or by direct pressure and boiler feed connection from the mains beyond the check valve, with the necessary connection for steam hose for steam flue cleaner, etc.,

The suction of the boiler feed pump shall be connected with the discharge main, and the discharge of feed pump will be connected with boilers.

There will be placed on the steam pump, a live steam separator. This separator shall be of the vertical pattern and the drip pipe shall be connected to sewer, so that the impurities and condensation shall be discharged therein.

All stop and regulating valves required for the control of the steam, exhaust and water connections, shall be included in the proposal.

All stop valves (except blow-off valves) either called for

or implied in this specification, shall be valves of make acceptable to the Engineer. All valves of three (3) inches diameter of connection, and larger, shall be of iron bodies with brass mountings, and all smaller valves shall be entirely of brass. The blow-off valves may be globe valves of brass. The steam valves over the domes of the boilers, and stop valves in the suction and discharge connections or pumps, shall be flange valves. All valves of four (4) inches and larger diameter, shall be flange valves.

The general plans in the office of the Water Works Committee, showing location of boilers, pumps, etc., shall be strictly adhered to in the location, arrangement, and dimensions of boiler, smoke connections, pumping engines, suction and discharge water pipes and valves, feed pump, steam and exhaust, and feed water and blow-off valves and pipes; and no proposal will be formal which requires changes in the dimensions of engine room or boiler room, or in the position of the suction and discharge main or chimney.

Proposals under this specification, will be held to include all materials, tools, labor and transportation necessary or incidental to the completion of the within described machinery, all and singular, ready for daily service in the pumping station of the Gary Water Works, including masonry foundations for boilers above referred to.

It is the purpose of this specification to hold the contractor responsible for all risks of every nature involved in the construction, and above mentioned tests of his machinery, and for all delays occasioned by defective or incomplete work.

The machinery as a whole, and all the details and trimmings, shall be subject to the approval of the Engineer, and such parts as may be rejected shall be promptly replaced with other parts

which are satisfactory, at the cost of the contractor, and without delay to the work.

The custody of the machinery will be with the contractor until it has been started, tested and accepted for service by the Engineer, and any damage or injury sustained by the machinery previous to acceptance for service, must be repaired at the cost of the contractor.

Every proposal must definitely state the time within which the work herein contemplated will be completed after an award of contract. Said time to include all delays and hindrances, whatsoever. Other things equal, preference will be given the proposal offering the earliest completion of the work.

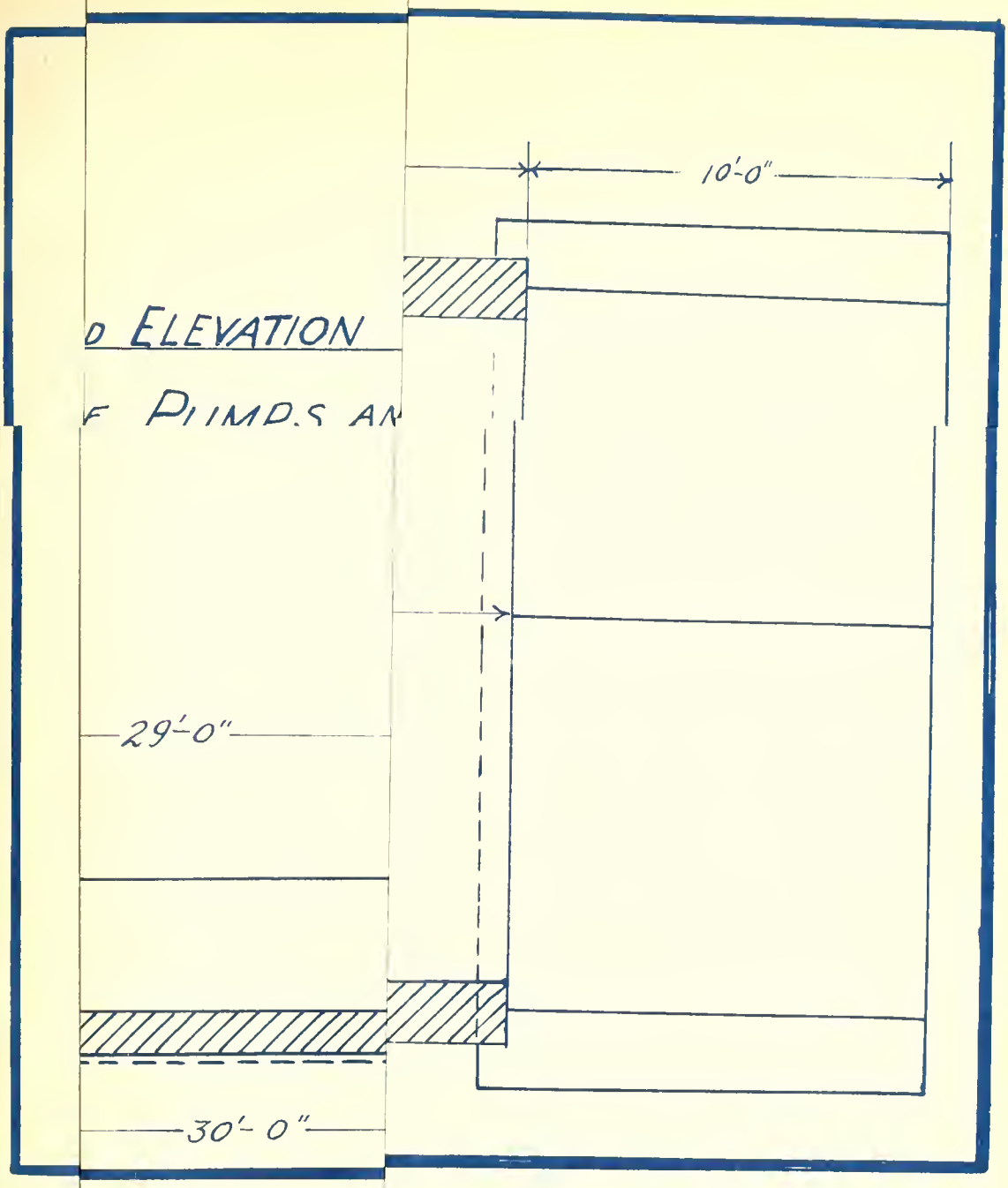
The right is reserved to reject any and all bids.

which are satisfactory, in the opinion of the contractor, carried out during to the work.

The method of the working will be with the contractor until it has been started, upon which acceptance for service by the Engineer, and any change or improvement by the contractor previous to acceptance for service, must be regarded at the cost of the contractor.

Every precaution must be taken to avoid the [illegible] which the work herein contemplated will be completed after an [illegible] contract. Rail sidings in main or all stage [illegible], whatever or thin a cut, preference will be given to proposal offering the earliest completion of the work.

The right is reserved to reject any or all bids.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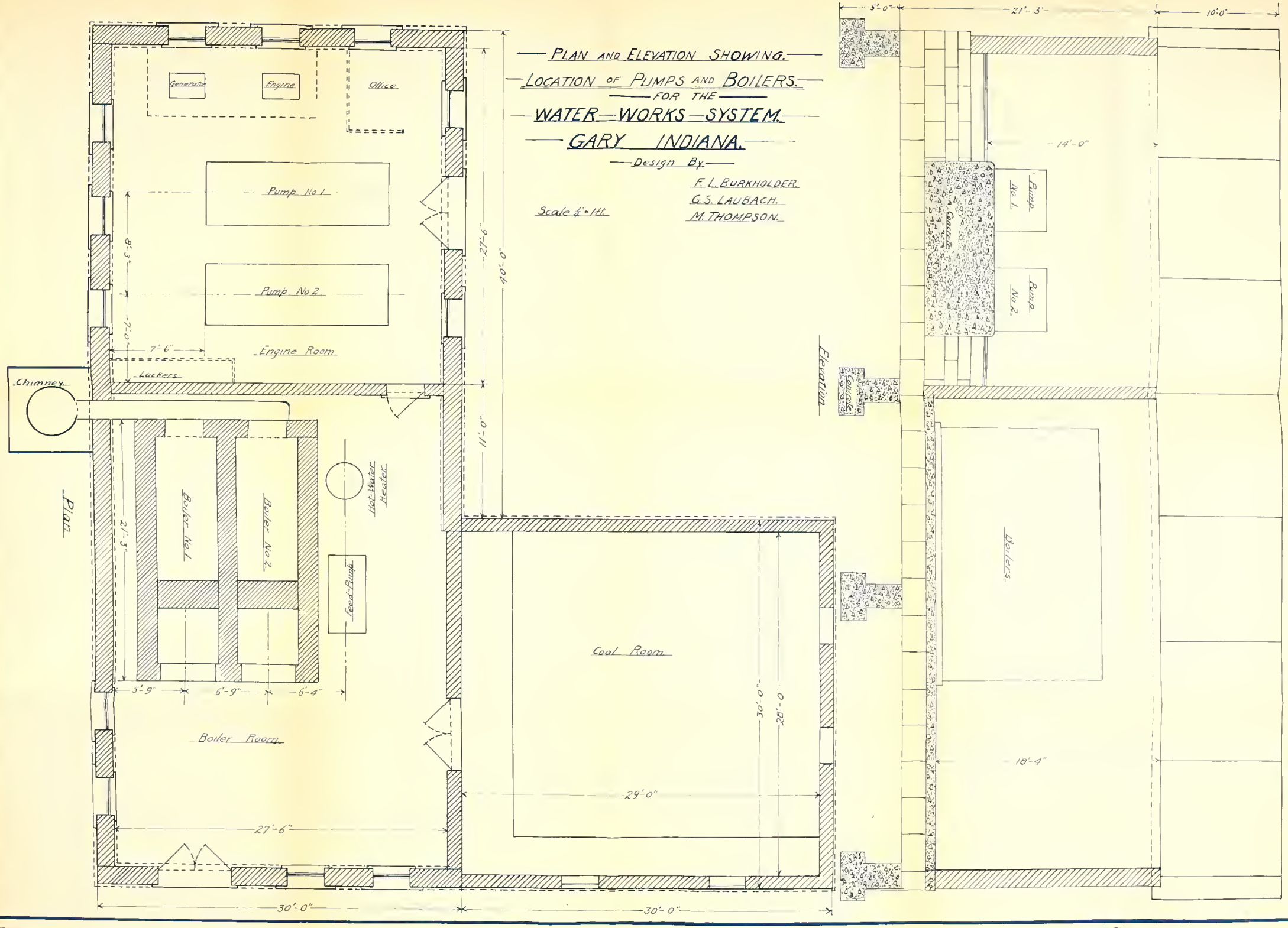
F PIIMD.S AN
29'-0"
30'-0"

[illegible] are artificial; [illegible] the contractor, [illegible] it out [illegible] to the work.

The question of the machinery will [illegible] the contractor until it has been started, [illegible] acceptable for a [illegible] by the Engineer, and any change of type substituted by the machinery provided to be adequate for service, must be approved at the cost of the contractor.

Every precaution must definitely state the [illegible] [illegible] the work herein contemplated will be completed after [illegible] of contract. Paid time to include all delays and hindrances, whatsoever, over which one of, preference will be given the legal officers the earliest courtesy to the contract.

The right is reserved to reject any or all bids.


PLAN AND ELEVATION SHOWING
LOCATION OF PUMPS AND BOILERS
FOR THE
WATER WORKS SYSTEM
GARY INDIANA
Design By
F. L. BURKHOLDER
G. S. LAUBACH
M. THOMPSON
Scale ¼" = 1 Ft.
Generator
Engine
Office
Pump No. 1
Pump No. 2
Engine Room
Lockers
Chimney
Boiler No. 1
Boiler No. 2
Hot-Water Heater
Feed-Pump
Boiler Room
Coal Room
Plan
Elevation
Pump No. 1
Pump No. 2
Gauges
Boilers
27'-6"
40'-0"
11'-0"
8'-3"
7'-6"
21'-3"
5'-9"
6'-9"
6'-4"
30'-0"
29'-0"
28'-0"
5'-0"
14'-0"
18'-4"
10'-0"

SPECIFICATIONS FOR PUMPING STATION

and CHIMNEY.

-oOo-

The building of pumping station will include the excavation for foundations and construction of pumping station and chimney, in accordance with the plans and specifications and their expressed and implied intention.

The bottom of the trench for the footing course shall be excavated truly level and rammed so as to provide an even bearing over its entire surface.

All brick used in the construction of the building shall be good merchantable brick, of uniform size and color, and with sharp edges. They shall be laid in good, well slacked lime mortar. They will be laid truly to line and with one-quarter (1/4) inch joints; five courses of stretchers to one of headers. All joints must be well filled with mortar and each brick well bedded.

In the engine and boiler rooms, the brick work must be truly to line on the inside of the wall; the surface and joints must be filled full of mortar, (and the surface rubbed smooth),

All outside doors of building will be provided with cut stone sills, and not less than six (6) inches thick, and of the same width as the walls. All windows will be provided with cut stone sills not less than four (4) inches thick and six (6) inches wide. All openings for doors and windows, shall be arched.

[illegible] ATION FOR PURPI[illegible]

and CHIMNEY.

-oOo-

The building of pumping station will include the [illegible] for foundations and construction of pumping station and chimney, in accordance with the plans and specifications and their expressed and implied intention.

The price of the tender for the foundations must be exceeded firmly fixed and [illegible] as to provide an over boarding over the entire surface.

All brick work in the construction of the building [illegible] be good merchantable brick, of uniform size and color, [illegible] sharp edges. They shall be laid in good, well [illegible] like mortar. They will be laid truly to line and with cross-joints (1/1) inch [illegible]; five courses of stretchers to one of header. All joints must be well filled with mortar and each brick well bedded.

In the engine and boiler room, the brick work must be [illegible] truly to line on the inside of the walls; the exterior may be [illegible] full of mortar, (see the specifications [illegible]).

All outside corners of building will be provided with cut stone quoins, and not less than [illegible] (8) inches thick, [illegible] width as the walls. All windows will be provided with [illegible] sills not less than four (4) inches thick and six (6) inches [illegible]. All openings for doors in stone, shall be [illegible].

The brick work shall be carried up between the rafters and on the level with the top of same. A wall plate 2 x 8 inches shall be laid on top of the brick work and anchored securely by bolts of the number and dimensions shown on the plans. The rafters, ceiling joists and tie beams in the boiler room shall be surfaced, and all joints accurately made so as to present a neat appearance.

Over the center of the boiler room shall be placed a galvanized iron ventilator of an approved design, not less than twenty-four (24) inches in diameter.

There shall be provided a No. 3 eight (8) inch whistle (single bell chime). Connections to this whistle shall be (2) inch pipe, and be so connected that steam can be used from either boiler. The whistle shall be set about six (6) feet above the roof.

All doors and windows shall be of a size shown on the plans. The material for the doors shall be of the best quality, one and three-fourth (1 3/4) inches thick. The door frames shall be made of two (2) inch stuff, thoroughly seasoned and not less than eight (8) inches wide, except for double doors for pump room which shall be 2 x 12 inches. They shall be securely set and firmly fastened to blocks laid in the walls.

There shall be provided a suitable trap door with hinges and ring, placed in the floor to give access to the pipe and fittings beneath.

The joists overhead in the engine room shall be lathed and plastered with adamant in a manner acceptable to the water-works committee.

All woodwork shall be painted three (3) coats, lead in oil; colors to be selected,

The soil under engine room floor shall be excavated to a

The [illegible] shall [illegible]

on the level with the top of sash. [illegible] line on top of the brick wall [illegible] inner and the outer [illegible]. joints and the holes in the belfry [illegible] joints accurately [illegible].

Over the center of the [illegible] shall be placed galvanized iron ventilator [illegible] twenty-four (24) inches in diameter.

There shall be provided [illegible] eight (8) [illegible] (single bell chime). Connections to the whistle shall be (2) inch pipe, and be connected that steam [illegible]. The whistle shall be set about six (6) feet above the roof.

All doors [illegible] plans. The material [illegible] shall be of the best quality, and shall be tongued and grooved (1 3/4) inch [illegible]. The door frames shall be made of two (2) inch [illegible], carefully [illegible] and not less than eight (8) inches wide, except for [illegible] shall be [illegible] inches. They shall be securely set and firmly [illegible] in the [illegible].

There shall be provided [illegible] and [illegible], placed in the floor [illegible].

The [illegible] shall be [illegible] with [illegible] the [illegible] concrete.

All exterior shall be painted three (3) coats, [illegible] colors [illegible] selected.

The [illegible] floor [illegible]

depth sufficient to give three (3) feet in the clear between the bottom of joists and ground, and all dirt thus excavated and all dirt excavated from the reservoir not needed for grading around same, shall be neatly graded around power house as directed by the Water Works Committee.

Provision shall be made in walls and roof for all pipes, blow-offs, etc. Provision shall be made in boiler room for flue connection from boilers to chimney. Provision shall be made in foundation for suction and discharge mains; said pipe to be laid in trenches approximately five (5) feet six (6) inches in depth. Provision shall be made for a sewer to run outside of building at such place as may be designated by the Water Works Committee.

CHIMNEY

There shall be built of brick a smoke stack sixty (60) feet high and thirty (30) inches inside diameter. This stack shall be built of a good quality of hard burned brick laid in cement mortar consisting of one (1) part of Louisville cement (or its equivalent) to three (3) parts of clean, sharp sand, and shall be lined with fire brick at least four (4) feet above opening for breaching. The opening for the breeching or smoke connection shall be arched. There shall be an iron ash door with suitable frame placed at the base of the stack. The top of the stack shall be capped with a cast iron plate not less than one (1) inch thick. The foundation shall be of concrete. Concrete to be mixed in same proportions as for floors of reservoir.

The contractor shall furnish all transportation, material (except stone for rubble masonry and concrete) and workmanship necessary and indidental to the proper carrying out of the work,

[illegible] sufficient to [illegible] [illegible]
bottom of [illegible] [illegible], [illegible] [illegible]
[illegible] from the [illegible] [illegible] [illegible]
shall be [illegible], [illegible] [illegible] [illegible]
Work Committee.

Provision shall be made in [illegible] [illegible],
[illegible]-offs, etc. Provision shall be made in [illegible] for the
connection the [illegible] to a [illegible]. Provision [illegible]
foundation for [illegible] and [illegible] [illegible] [illegible]
in trenches approximately five (5) feet six (6) inches in depth.
Provision shall be made for a [illegible] [illegible]
[illegible] plan as may be [illegible] by the [illegible] [illegible].

[illegible]

There shall be built [illegible] [illegible] at [illegible] (60)
[illegible] and eight (8) [illegible] [illegible]. The [illegible]
built of a good [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] of one (1) [illegible] [illegible] [illegible] (or [illegible]
[illegible] (3) [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] (1) [illegible] [illegible] [illegible] [illegible].
The [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] of the [illegible]. [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] (1) [illegible] [illegible]. [illegible]
[illegible] of [illegible]. [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

embraced under this specification, and the proposal shall be for the work complete, including all excavation, foundation, etc. All materials, cement and sand and all workmanship, shall be subject to the approval of the Engineer; and all material and workmanship which may be rejected shall be promptly removed from the grounds and replaced with satisfactory material or workmanship, at the cost of the contractor, and without delay in the completion of the work.

The plans referred to in this specification shall be understood to mean the drawings especially prepared for this work on file in the office of the Water Works Committee. Any additional drawings that may be necessary to the proper understanding of the work embraced under this specification, will be furnished by the Engineer upon application.

Proposals shall state the time for the delivery of the materials and completion of the work under this specification. Other things equal, preference will be given to the proposal offering the earliest completion of the work.

The contractor will be required to forfeit, as confessed and liquidated damages, to the city, the sum of Fifteen Dollars ($15.00) per day, for each and every day the final delivery and erection is delayed beyond the time specified in his proposal, and he will be required to reimburse said city for any and all damages and increased costs of the work to the city by reason of such delay, and to act as defendant in any and all suits which may be brought against the city by reason of such delay, or from any other cause connected with his or their contract with the city.

During the last week of each month, the Enginner will make an estimate of the materials furnished and the work completed under this specification during that month, Eighty (80) per cent of the amount due, will be paid upon the fifteenth (15th) of the succeeding

contractor with [illegible] satisfactorily, at [illegible] expense [illegible] and [illegible] for the work complete, including all excavating, [illegible] backfilling, etc. All materials, supplies and [illegible] [illegible] [illegible], [illegible] [illegible] the approval of the Engineer; [illegible] [illegible] [illegible] and any [illegible] [illegible] [illegible] [illegible] [illegible] finished with [illegible] [illegible] [illegible] [illegible] the contractor, [illegible] [illegible] the completion of the work.

The plans referred to in this agreement should [illegible] understood to [illegible] [illegible] [illegible] on file in the office of the [illegible] [illegible]. Any additional drawings that may be necessary to the proper understanding of the work embraced under this specification, will be furnished by the Engineer upon application.

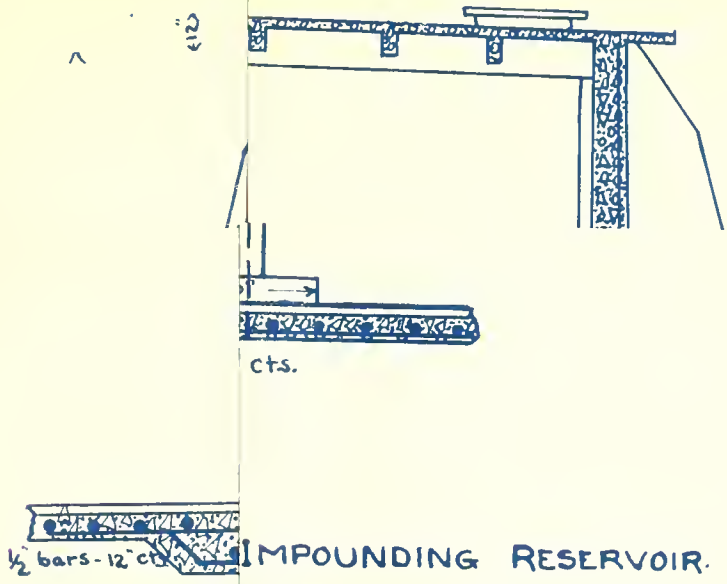
Proposals will state [illegible] [illegible] [illegible] the materials and supplies of the work called for in this specification. Other things being equal, preference will be given to the proposal [illegible] the shortest time for completion of the work.

The contractor will [illegible] [illegible] deposit, as [illegible] and liquidated damages, [illegible] [illegible], the sum of [illegible] Dollars ([illegible]) per day, for each and every day [illegible] [illegible] delivery or erection is delayed beyond the time specified in the proposal, and he will be required to reimburse the city for any [illegible] and increased costs of the work to the city by reason of such delay, and to hold the [illegible] [illegible] [illegible] against the city by reason of such delay, or [illegible] other [illegible] connected with [illegible] [illegible] the city.

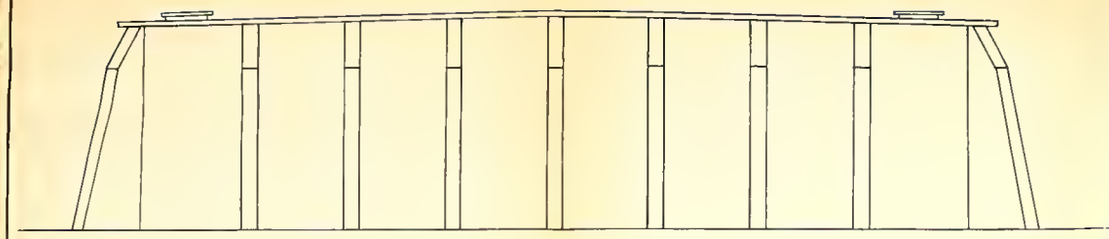
During the [illegible] [illegible], the Engineer will [illegible] [illegible] of the materials [illegible] [illegible] this specification [illegible] [illegible] each [illegible] [illegible] [illegible]

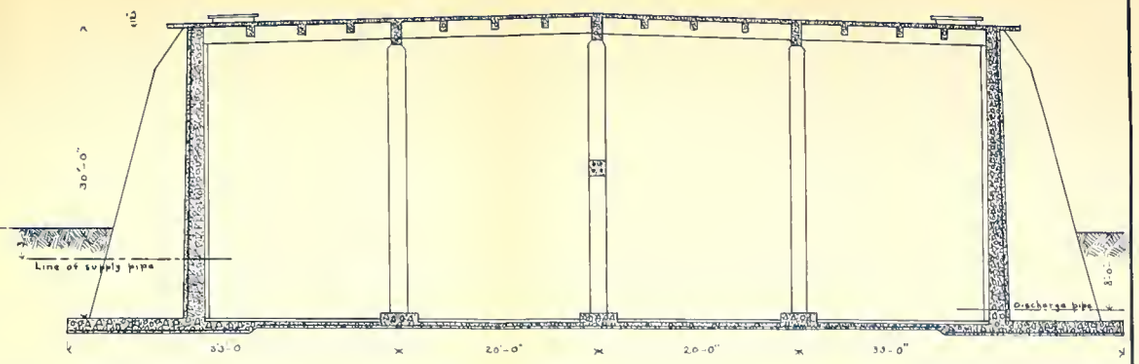
month. The balance (20 per cent) will be due and payable within sixty (60) days of final completion and test and approval by the Engineer and acceptance by the Water Works Committee.

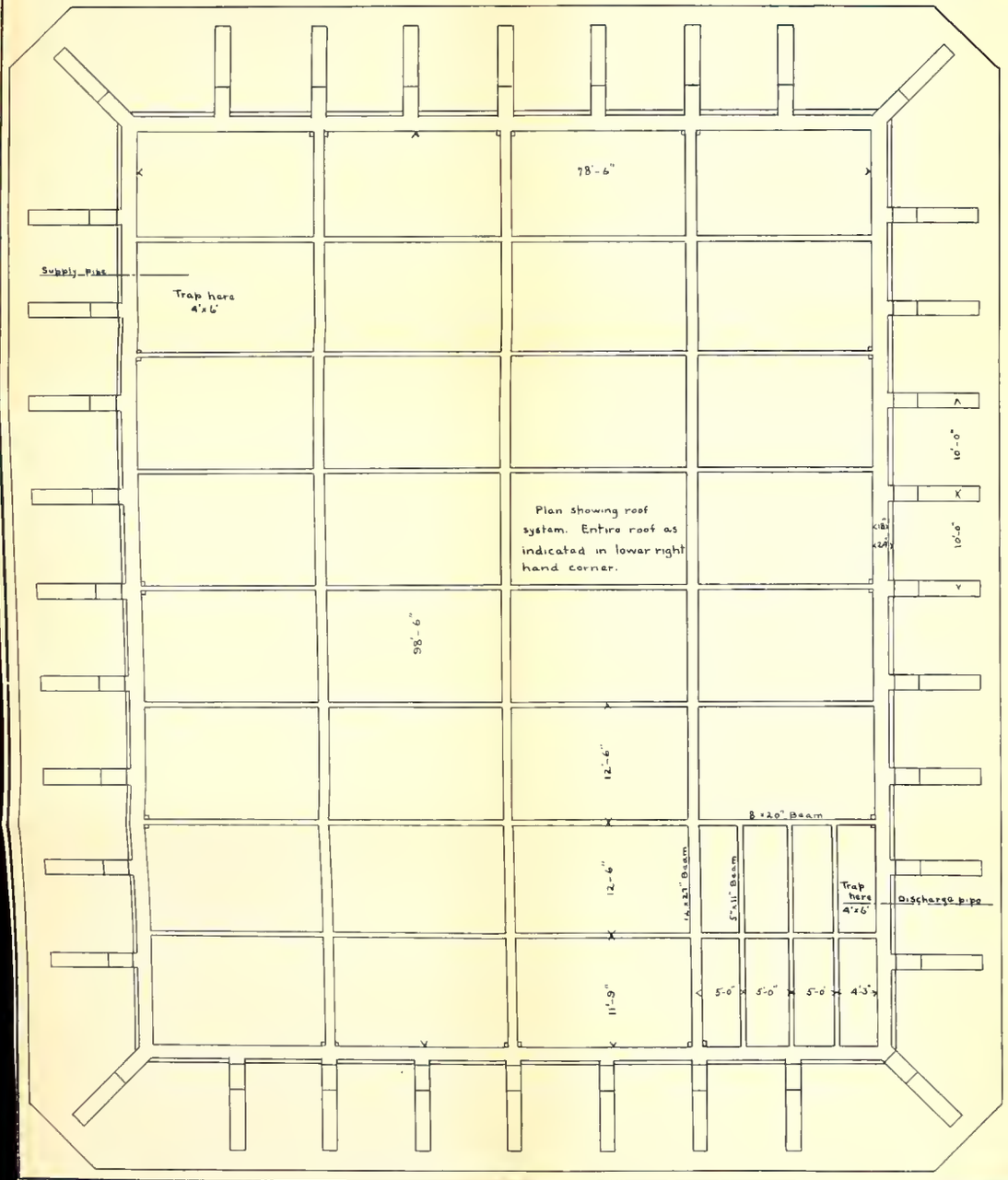
The right is reserved to reject any and all bids.

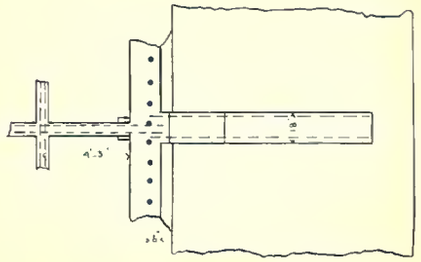


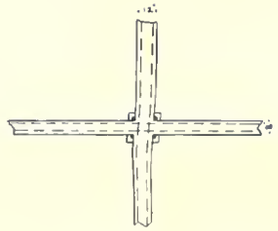
top to bottom, and then laying the concrete continuously to required height between these bulkheads.

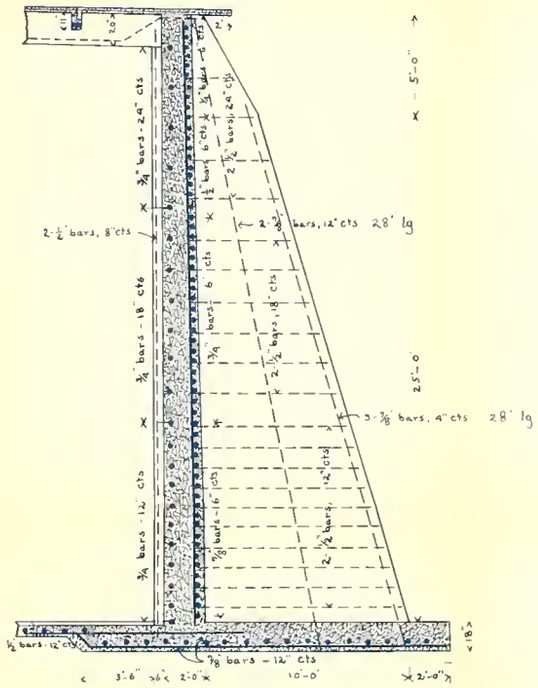




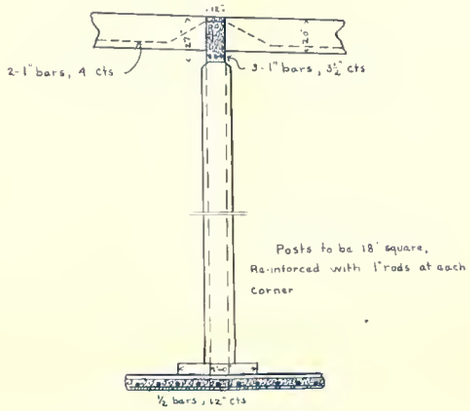








Floor of reservoir to be of 1-2-4 concrete, 6" thick and covered with 1" coat of asphalt.



REINFORCED CONCRETE IMPOUNDING RESERVOIR
For The
WATER WORKS OF GARY INDIANA.

Scale { Plan & Elevation — 1/8" = 1'
Details — 1/4" = 1'

Designed by { F L Burkholder
G S Laubach.
M Thompson.

SPECIFICATIONS FOR REINFORCED CONCRETE RESERVOIR

1,800,000 gallons capacity.

There shall be built at a point indicated, and within lines to be given by the Engineer, a reinforced concrete reservoir of rectangular plan, 80' x 100', and 30' inside height.

The side walls to be supported by counterforts every ten (10) feet; these counterforts to be built as shown on plan.

The floor of the reservoir to be constructed of 1 - 2-4 concrete, six (6) inches thick, and covered with a one (1) inch thick coat of asphalt to insure water tightness.

Reservoir floor to be continuous under counterforts and eighteen (18) inches thick at that point. Reinforced as shown in details. Entire floor must be run without allowing concrete to set. If contractor's mixing machine is too small to admit of this being done, the entire floor may be laid to a depth of three (3) inches in one run, and then the last three (3) inches put on later, making the joint between courses horizontal.

A key twelve (12) inches wide and ten (10) inches deep to be left all around floor and just under the walls. This will insure a good bond between floor and walls, and prevent leakage.

All joints between courses in wall must be vertical and be just in front of a counterfort. This can be accomplished by building a bulkhead in the center of every fourth counterfort, from top to bottom, and then laying the concrete continuously to required height between these bulkheads.

[illegible]

[illegible] 1,000,000 [illegible] [illegible].

[illegible] will be built in [illegible] [illegible], and this [illegible] to be [illegible] by the [illegible], [illegible] [illegible] [illegible]

Expansion joints must be made every twenty (20) feet in the roof. To do this, divide every fourth 5" x 11" beam in the roof by a 1/4 inch thickness of asphalt.

Walls, roof, and all roof beams to be coated, on the inside of tank, with a 1-2 mixture of mortar.

Reinforcing to be put in as indicated in the plans and to consist of corrugated steel bars of the size designated.

Floor of reservoir to be laid ten (10) feet below ground level and the trench back filled and tamped after reservoir is completed.

Provision shall be made in the wall for the entrance of the supply pipe (24 inches in diameter) and the exit of discharge pipe. Care must be taken to make the joints around the pipes thoroughly water tight.

There shall be provided in the roof two (2) trap doors, at the places indicated in plan, to permit access to the interior of the reservoir.

The proposal for the reservoir must be for the work complete, including valve-chamber and all pipe connections, excavation and back-fill (back-fill around outside of reservoir) and shall state the time of completion. Other things equal, preference will be given to the proposal offering the earliest completion.

The contractor will be required to forfeit, as confessed and liquidated damages, to the city, the sum of Fifteen Dollars ($15.00) per day, for each and every day the final delivery and erection is delayed beyond the time specified in his proposal, and he will be required to reimburse said city for any and all damages and increased costs of the work to the city by reason of such delay, and to act as defendant in any and all suits which may be brought against the city

[illegible]

[illegible] (b) [illegible]

[illegible]

[illegible] 1/1 inch [illegible] of [illegible].

[illegible], [illegible], [illegible], [illegible], [illegible]

of [illegible], with a 1-2 [illegible] of [illegible].

[illegible], [illegible] [illegible]

to [illegible] of [illegible] [illegible].

Floor of [illegible] [illegible] (1) [illegible]

level [illegible] the [illegible] [illegible] [illegible]

[illegible].

[illegible]

[illegible] supply line [illegible]

[illegible]. [illegible]

[illegible] [illegible]

[illegible]

at the [illegible] [illegible]

the reservoir.

[illegible]

including [illegible]

[illegible]-fill (bird-[illegible]) [illegible]

[illegible] of [illegible]. [illegible]

[illegible]

[illegible]

[illegible]

[illegible] [illegible] [illegible]

required [illegible]

[illegible]

[illegible]

by reason of such delay, or from any other cause, connected with his or their contract with the city.

During the last week of each month, the Engineer will make an estimate of the work completed under this specification during that month. Eighty (80) per cent of the amount due will be paid upon the fifteenth (15th) of the succeeding month. The balance (20 per cent) will be due and payable within sixty (60) days of final completion and test and approval by the Engineer, and acceptance by the Water Works Committee.

The right is reserved to reject any and all bids.

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by reason of such delay, or for any other cause, contrary to his or their control with the city.

Next, the first week of each month, the engineer will submit an estimate of the work completed during the preceding month that month. Fifty (50) per cent of this amount the will be paid upon the fifteenth (15th) of the succeeding month. The balance (50 per cent) will be due and payable within sixty (60) days of final completion and test and approval by the Engineer, or acceptance by the Water Works Committee.

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LA SHOWING.

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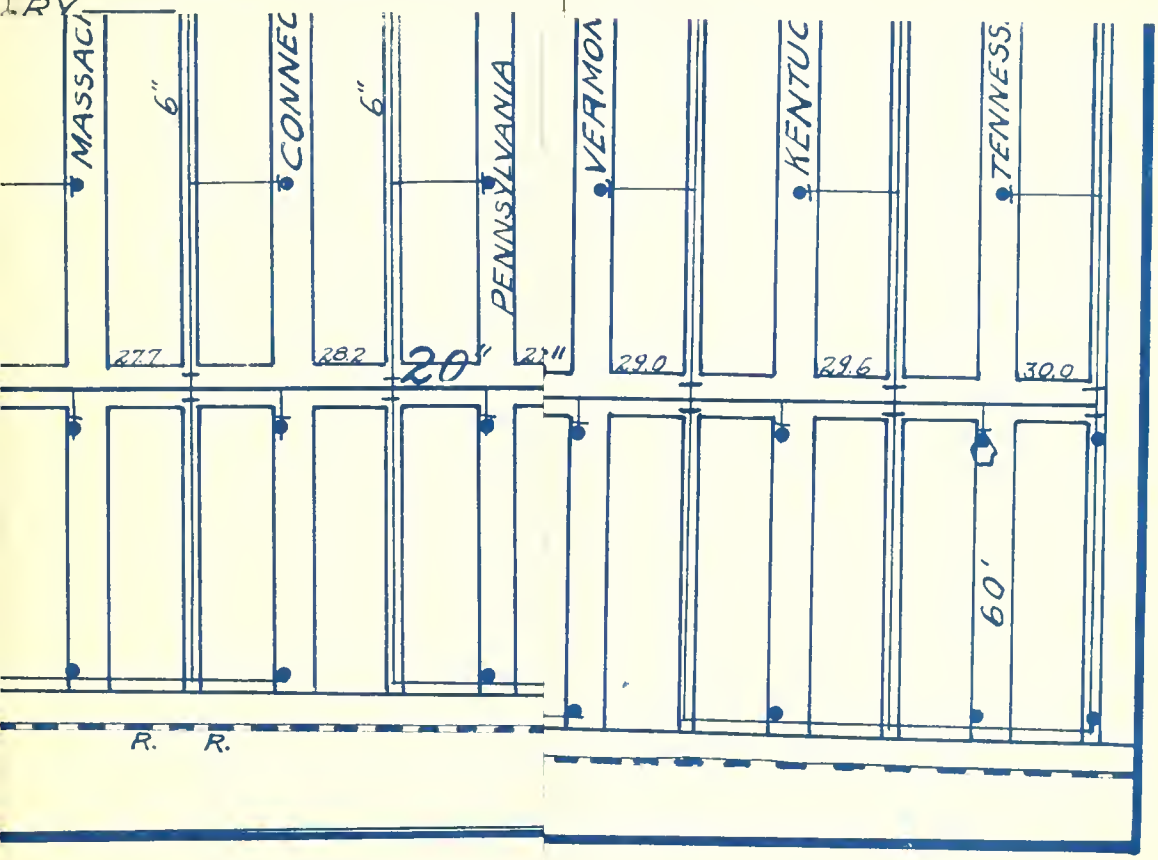
VATER WORK

INDIANA.



by a [illegible] or [illegible] [illegible], [illegible] [illegible] life or their contract with the city.

During the last [illegible] [illegible], the engineer will be an estimate of the work completed under this agreement during that month. Eighty (80) per cent of the amount due will be paid upon the fifteenth (15th) of the succeeding month. The balance (20 per cent) will be due and payable within sixty (60) days of final completion and test and approval by the Engineer, and acceptance by the Water Works Committee.

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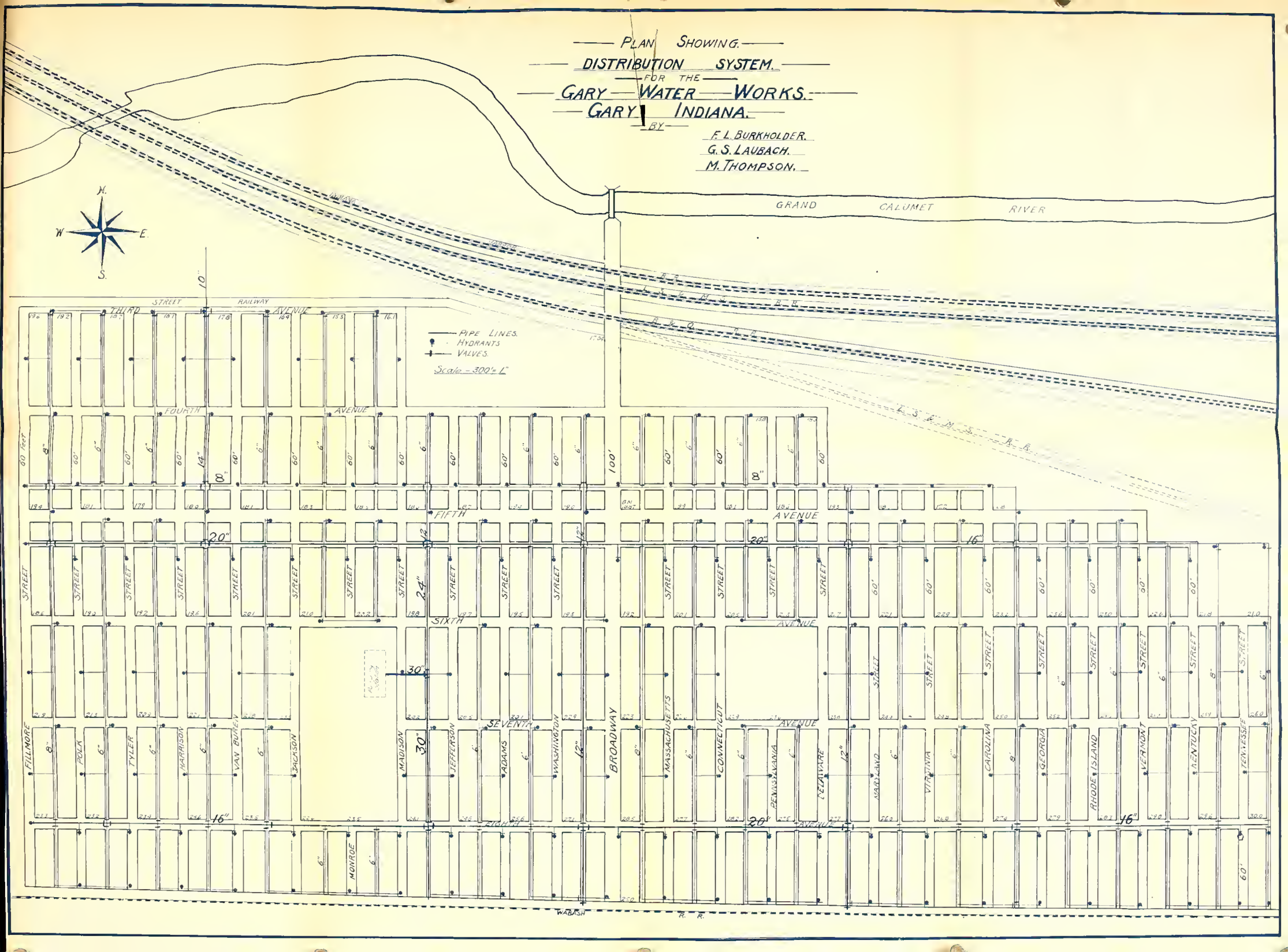
PLAN SHOWING
DISTRIBUTION SYSTEM.
FOR THE
GARY WATER WORKS.
GARY INDIANA.
BY
F. L. BURKHOLDER.
G. S. LAUBACH.
M. THOMPSON.
N.
S.
E.
W.
GRAND CALUMET RIVER
THIRD AVENUE
FOURTH AVENUE
FIFTH AVENUE
SIXTH AVENUE
SEVENTH AVENUE
EIGHTH AVENUE
RAILWAY STREET
PIPE LINES.
HYDRANTS
VALVES.
Scale - 300' = 1"
FILLMORE STREET
POLK STREET
TYLER STREET
HARRISON STREET
VAN BUREN STREET
JACKSON STREET
MADISON STREET
JEFFERSON STREET
ADAMS STREET
WASHINGTON STREET
BROADWAY
MASSACHUSETTS STREET
CONNECTICUT STREET
PENNSYLVANIA STREET
DELAWARE STREET
MARYLAND STREET
VIRGINIA STREET
CAROLINA STREET
GEORGIA STREET
RHODE ISLAND STREET
VERMONT STREET
KENTUCKY STREET
TENNESSEE STREET
MONROE STREET
WABASH R. R.